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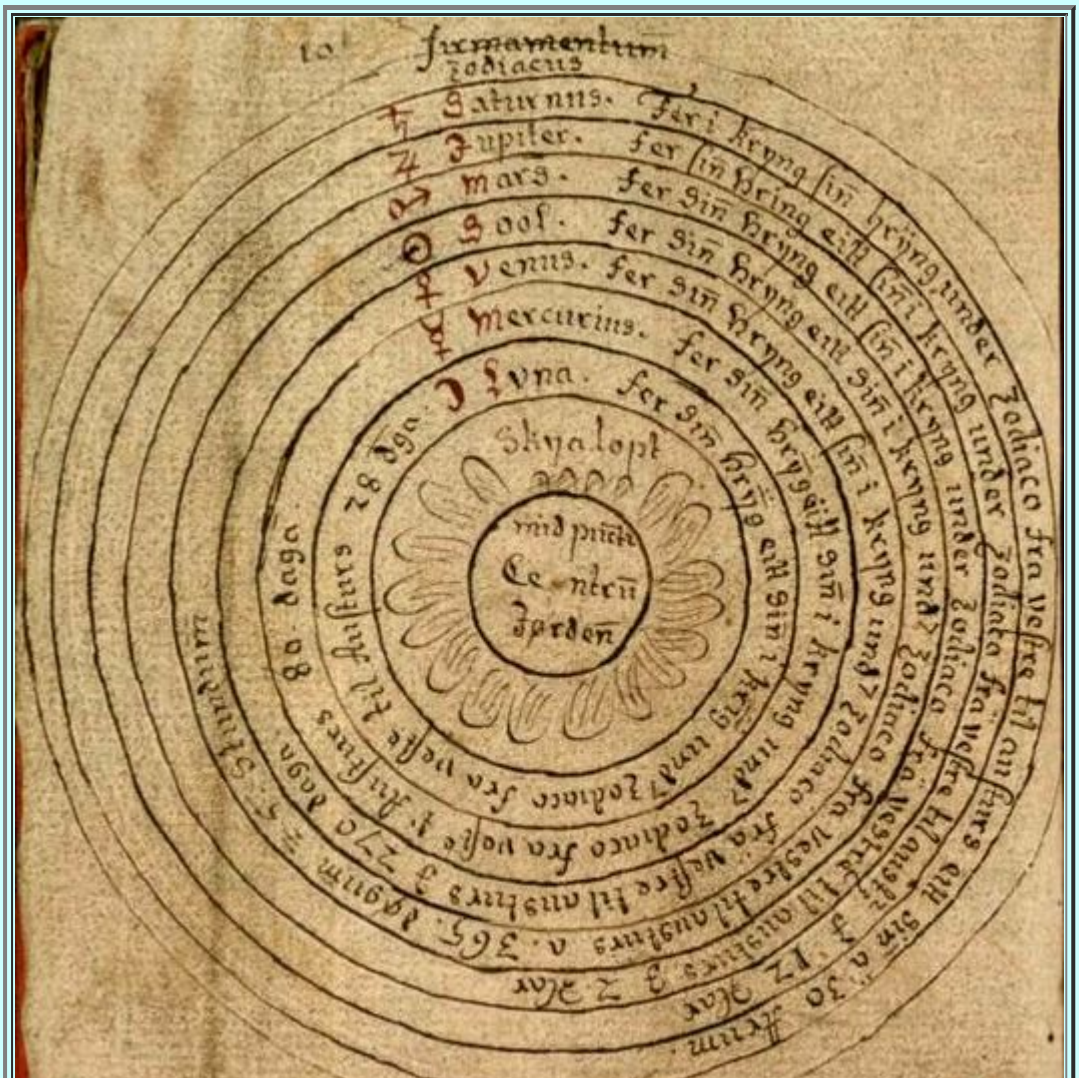
The Ptolmeic (Geocentric, or Earth-centered) Model of the Solar System

Cladius Ptolemy
Greek astronomer and mathematician
Modeled the movements of the Sun, the Moon, and the five known planets (Mercury, Venus, Mars, Jupiter, and Saturn) in the skies to great accuracy, with a geocentric system of orbits and epicycles.
Born: 85 in Egypt
Died: 165 in Alexandria, Egypt

Quotation: When I trace at my pleasure the windings to and fro of the heavenly bodies, I no longer touch the earth with my feet: I stand in the presence of Zeus himself and take my fill of ambrosia, food of the gods.
C B Boyer, A History of Mathematics (New York 1968)

In the geocentric system, the Earth is considered to be the center of the solar system. The Moon, the planets, the Sun, and the stars all rotate around the Earth (which stays still), with uniform circular motion. They compose the heavens, which are considered to be ethereal and unchanging.



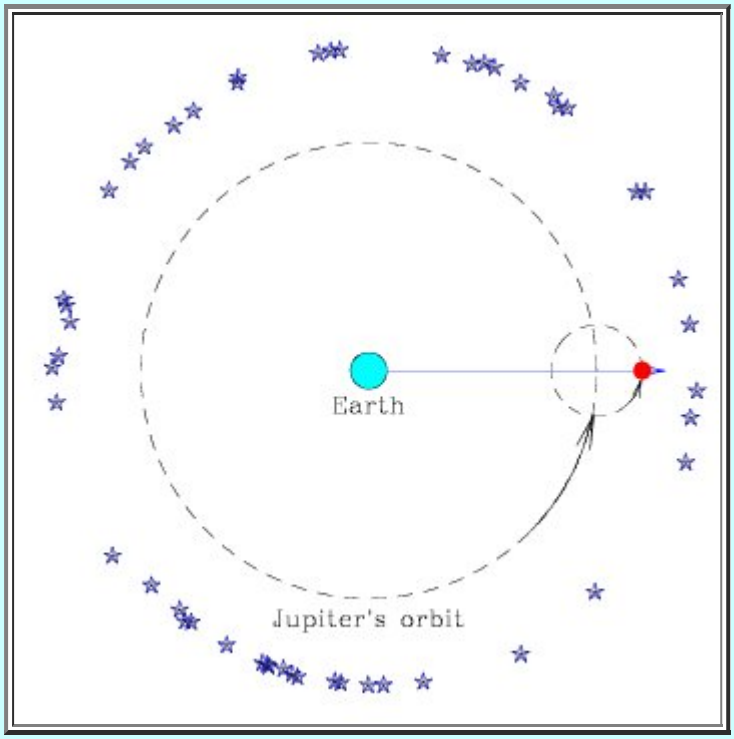
An Icelandic manuscript from roughly 1750, depicting the geocentric model of the solar system.

Aristotle argued strongly in favor of this system, on the grounds that if the Earth itself were to be moving:

- We would be aware of the movement of the ground or the air.
- The apparent position of nearby stars would change in the sky (parallax).
- But why did the planets display retrograde motion, moving both forwards and backwards on the sky?
- And why did the planets appear brighter at certain times than others?

To explain the orbits of the Moon and planets in this system, it was not enough to have them travel on circular paths (deferents) about the Earth. Each one traveled on a small circular orbit (an epicycle) which in turn traveled on a larger deferent about the Earth. This combination, rather like the interlocked gears of a mechanical clock or watch, produced a path which matched the observed non-circular elements of the planetary orbits.

The next figure shows how a deferent (large circle) and an epicycle (small circle) could produce both the overall prograde (counterclockwise) and the occasional retrograde (clockwise) motion of the planet Jupiter under the geocentric system. The red dot shows the location of Jupiter, and the blue line shows how it would shift forward and backward against background stars.



Consider two interesting links about celestial navigation in the past: (1) Is the Pleiades star cluster depicted in prehistoric cave paintings in Lascaux? (2) Is the biblical story of Samson and the Philistines a clever navigational map of the sky, built from the legends of Gilgamesh?